Conclusion: Locking plates are a useful means of treating distal tibial metaphyseal fractures. It minimizes further soft tissue injury and allows most patients to return to pre-injury levels of activity.


2B.23

Explosion-mediated fracture patterns relate to environment: a forensic biomechanical approach

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Introduction: Civilian fractures have been extensively studied with in an attempt to develop classification systems, which guide optimal fracture management, predict outcome or facilitate communication. More recently, biomechanical analyses have been applied in order to suggest mechanism of injury after the traumatic insult, and predict injuries as a result of a mechanism of injury, with particular application to the field so forensics. However, little work has been carried out on military fractures, and the application of civilian fracture classification systems are fraught with error. Explosive injuries have been sub-divided into primary, secondary and tertiary effects. The aim of this study was to

1. determine which effects of the explosion are responsible for combat casualty extremity bone injury in 2 distinct environments: (a) in the open and (b) enclosed space (either in vehicle or in cover);
2. determine whether patterns of combat casualty bone injury differed between environments.

Invariably, this has implications for injury classification and the development of appropriate mitigation strategies.

Method: We reviewed all ED records, case notes, and radiographs of patients admitted to the British military hospital in Afghanistan over a 6-month period April 08–September 08 to identify any fracture caused by an explosive mechanism. Paediatric cases were excluded from the analysis. All radiographs we independently reviewed by a Radiologist, a team of Military Orthopaedic Surgeons and a team of academic Biomechanists, in order to determine the fracture classification and predict the mechanism of injury.

Early in the study it became clear that due to the complexity of some of the injuries it was inappropriate to consider bones separately and we used the term ‘Zone of Insult’ (ZoI) to identify separate areas of injury.

Results: We identified 62 combat casualties with 115 ZoIs (mean 1.82 zones), 34 casualties in the open sustained 56 ZoIs (mean 1.65); 28 casualties in the enclosed group sustained 59 ZoIs (mean 2.10). There was no statistical difference in the mean ZoIs per casualty in the open vs. enclosed group (Student t-test, p = 0.24). Open fractures were more prevalent in the open group compared to the enclosed group (48/59 vs. 20/49, Chi-squared test p < 0.001).

Of the casualties in the open, 1 zone of injury was due to the primary effects of blast, 10 a combination of primary and secondary blast zones, 23 due to secondary effects and 24 from the tertiary effects of blast. In contrast, there were no primary or combined primary and secondary blast zones and only 2 secondary blast zones in the enclosed group. Tertiary blast effects predominated in the enclosed group, accounting for 96% of injury zones (57/59).

Analysis of the pattern of injury revealed that there were a higher proportion of lower limb injuries in the Enclosed group (54/59) compared to the Open group (40/58, Chi-squared p < 0.05).

In the Open group the mechanism of lower limb injury was more evenly distributed amongst mixed primary and secondary blast effects (10), secondary (10) and tertiary (20). In the enclosed group, lower limb injuries were almost exclusively caused by tertiary blast effects (47/48). A similar pattern was also seen in the Upper limb with 4/5 in the enclosed group was injured by tertiary effects compared to 4/18 in the Open Group. In the open group fragmentation injury was the predominant cause of injury (13/18).

Conclusions: Our data clearly demonstrates two distinct injury groups based upon the casualties’ environment. The enclosed environment afforded by buildings and vehicles appears to mitigate the primary and secondary effects of the explosion. However, tertiary blast effects were the predominant mechanism of injury, with severe axial loading to the lower extremity being a characteristic of the fractures seen.

In contrast, secondary fragments from the explosion were more likely to result in fractures of casualties caught in the open. The development of future mitigation strategies must be focused on reducing all the different mechanisms of injury caused by an explosion. This will require a better understanding on the effects of bone in high strain environments. We believe that this method of forensic biomechanics involving clinicians and engineers, combined with accurate physical and numerical simulations can form the basis in reducing the injury burden to the combat soldier.


2B.24

A recent dataset of traumatic brain injury demonstrates that brain swelling and brain stem injury are the only significant predictors of outcome among various computed tomography (CT) findings

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Introduction: Various CT findings in traumatic brain injury (TBI) can help to predict patients’ outcome. CT findings can be categorised using the Marshall Classification or the Abbreviated Injury Score (AIS) dictionary or can be described through traditional terms referring to the type of injury such as subarachnoid haemorrhage (SAH), subdural haemorrhage (SDH), epidural haemorrhage (EPH), etc.

Objective: To determine which CT classifications and types of brain injury are more valuable for outcome prediction following TBI.

Method: A dataset of TBI patients in the Trauma Audit and Research Network (TARN) comprising 801 cases was analysed using logistic regression. Initially reference models were constructed with age, Glasgow Coma Scale (GCS), pupillary reactivity, Injury Severity Score (ISS), cause of injury and presence/absence of extracranial injury as predictors and survival at discharge as outcome. Subsequently, various CT classification (the Marshall Class